Two Approaches to Modularity: Comparing the STOP Approach with Structured Writing

by Robert E. Horn
Visiting Scholar
Stanford University

Background

The first time I heard of the STOP paper was sometime in the mid 80's when the historian of technical writing, John Brockman, phoned me to ask if my Information Mapping method of structured writing derived from the STOP method. At the time I told Brockman that there was no direct relationship between our two approaches since I'd never read the paper. When the editor of this journal sent me the STOP document in preparation for writing this paper, I read it with delight. Although our two innovations date from the same period, the STOP authors and I were working in two completely different disciplines, cultures, organizations, and locations. These two approaches resulted in modularity - albeit of quite different kinds. The main purpose of this project is to compare and contrast these two approaches to modularity. I should note here that I approach this article principally as an exercise in historical comparison, rather than as an exposition of my current views, about which I will say a bit at the end of this article.

Similarities

I am initially struck by the similarity of critiques of prose composition and the similarity of attitude and values toward communication of my work and the STOP originators. We were both interested in better comprehension on the part of the reader, and both identified the method of writing as part of the problem.

Perhaps this was part of the milieu of the times; both the work on STOP and my work were done during the same era. The STOP approach dates from the early 60's. I started working on educational technology in 1960. It was a heyday of innovation. Programmed learning, teaching machines, computer-based instruction, simulation, and many other innovations in education find their origins in this period. While there was a great excitement about the many possibilities of re-looking at instructional and communication problems, there was also a great confusion of theories and a lack of common language

for communicating among writers and scientists studying instructional and communication processes.   By 1965 I had a job of exploring both the theoretical and practical implications of a radical restructuring of how prose instructional writing could take place. Both the STOP authors and I were willing to make recommendations for major changes in the way technical writing should be done.

The most important similarity is that both the STOP authors and I came to the conclusion that some new form of modularity was needed. But there the similarities ended. The kind of modularity, its size, and its implications for the structure of documents are all quite different. It is these differences between the STOP approach and my structured writing approach that I want to consider in depth in this paper.

Differences between STOP and structured writing

Differences in milieu

STOP came out of the technical writing and engineering domains. It was created at Hughes Aircraft Company, in California, thus, born in the world of military-aerospace and was aimed at improving the writing and comprehension of proposals and reports.

My work on structured writing, and what was to be called Information Mapping® (See Note 4), was done as an academic researcher at the Institute for Educational Technology at Columbia University from 1963-65. I was interested in making learning materials, especially textbooks, easier and quicker to learn from. Structured writing came out of an intense interdisciplinary investigation that included educational psychology, cognitive science, and instructional design. (See Note 2)

STOP emerged out of the practical needs of communication in a complex environment.   STOP's critique is about the difficulty of reading and writing particular engineering documents.

My critique identified a more general requirement of writing and reading in the midst of a knowledge explosion, (See Note 1), and at the same time recognizing that we had no systematic theory for dealing with communication units that took into account scientific knowledge about how human beings dealt with information. I was interested in exploring the implications, for example, of George Miller's (1957) suggestion that human short term memory was extremely limited to seven plus or minus two chunks of information.

The resulting kind of modularity, the definition of the chunks, and the types of modularity that eventually emerged in the two approaches were quite different.

Content analysis and precision modularity

Perhaps the major difference between STOP and structured writing is that my work on structured writing is grounded in a detailed, layered, multi-functional and topical approach to content analysis, while STOP is focused on a topic approach only. The content analysis side of structured writing initially focused on devising a taxonomy and criteria for a new set of the smallest practical and functional unit of meaning for writing documents in the domain of relatively stable subject matter. A relatively stable subject matter is one that does not change very rapidly and can be thought of as the content found in many introductory texts, training manuals, and product and software documentation. Such stable subject matter is contrasted with disputed subject matter. (Horn 1989, Chapter 7) This work differed from the approaches to modularity taken by the STOP authors in that it focused on a deep understanding of the basic units of the subject matter. It depended for its success on the ability to teach others easily and with great uniformity, to sort sentences, diagrams, and illustrations of a subject matter into a comprehensive taxonomy of information blocks. (Horn 1992) (See Fig. 1) There is something fundamental about this taxonomy. It has proved capable of first-pass sorting of 80 percent or more of the sentences of virtually every subject matter that it has been applied to. Thus, the method can be said to capture and categorize the "core" sentences of the subject matter. This was facilitated by the discovery of an underlying structure of subject matter called the information types (See Note 3) that clustered information blocks into seven information categories. (See Fig. 2) It groups them into meaningful units for further refinement in the writing phase of documentation and training materials. STOP, on the other hand, tended to focus on the subject matter topic and not go further. Topic analysis of documents is important in structured writing but it is only half of the topic-block matrix that is used as the conceptual framework for thinking about subject matter. (See Fig. 3) I will discuss both the individual units and the taxonomic approach below.

The information block

What are blocks? Information blocks are the basic units of subject matter in structured writing analysis. They replace the paragraph as the fundamental unit of analysis and of presentation. STOP continues to use the conventional ideas of the paragraph. Blocks are composed of one or more sentences and/or diagrams about a limited topic. They usually have not more than nine sentences. They are always identified clearly by a label. The labels themselves follow specific guidelines. Information blocks are normally part of a larger structure of organization called an information map which can be defined as a

collection of one to nine blocks all related to a specific topic. In short, they are a reader-focused unit of basic or core parts of a subject matter.

Among the many constraints on the writing I established four principles: (1) The chunking principle (which says, "group all information into small manageable units"); (2) The relevance principle (which says "include in one chunk only information that relates to one main point based on that information's purpose or function for the reader"); (3) The consistency principle (which says "for similar subject matters, use similar words, labels, formats, organizations and sequences"); and (4) The labeling principle (which says "label every chunk and group of chunks according to specific criteria"). These principles, along with a significant number of specific guidelines and rules, give blocks the property of considerable precision. The initial kinds of blocks for relatively stable subject matters are shown in Fig. 1.

Modularity is a major concept in engineering. It has been thoroughly incorporated into software engineering as subroutines in computer programs which I had learned in the late 50's. The subroutine certainly influenced my work on developing information blocks. But, structured writing can claim to be the first to define and develop a precise modular concept ("information blocks") that is firmly grounded in a taxonomy of information types. (Note 3)

I developed the finite group of 40 information blocks after a process that involved looking at each sentence in introductory textbooks and trying to see if a functional taxonomy could be devised. It will be useful for the reader who is unfamiliar with the method for me to unpack the above sentences to give some depth of understanding to the concept of a finite group of precisely specified block types.

The precision modularity of blocks accomplishes a number of purposes. First, analysts/writers are guided in their debriefing of subject matter experts by a series of questions implied by the block types. When combined with the information types analysis (see below), it enables the writer/analyst to do completeness analysis (i.e. to determine within the bounds of possibility of today's level of technology, exactly when the analysis is complete and all information needed for the document has been gathered). When applied properly, it refines the basic idea of modularity to a place where each chunk of information can be considered a true subassembly for documentation engineering. Further, such precision enables the manager of documentation to specify guidelines and rules that apply only to certain types of blocks rather than to more fuzzily defined units, permitting the kind of efficiency, reliability and effectiveness that such standardization usually provides. It, thus, also permits reuse of blocks in multiple documents and the creation of databases built on such principles. Precision modularity provides the solid basis for assisting the analyst/writer in the organization/sequencing phase later on. It

also enables computer-based training and reference systems to be built on precision modularity.

Let us examine both the concept of precision modularity and then the concept of information types.

To summarize the major points of difference: The STOP approach had a fixed modular size of 2 pages. Structural writing's precision modularity focused on blocks of 1 to 9 sentences. The structured writing approach used a strongly taxonomic approach, while the STOP approach appears not to.

Intermediate size of the information map

An unending sequence of structured information blocks would fail to provide readers with natural and logical ways to cluster important concepts, procedures, processes, etc. It would be little better than an endless sequence of gray paragraphs one after another. It would hinder rather than aid searching for retrieval. To solve this problem, I developed and incorporated the concept of an intermediate size unit - the information map, as a collection of one to nine information blocks.

The information map provides an important level of specification of document organization. The information map concept enabled the clustering together of blocks all related to a topic (and where possible an information type) and suggested an appropriate labeling system for them. (See below for further discussion of labeling.) The information map enables the user/learner to receive all information connected with a particular topic together. This facilitates the organization of the document. The information map enables the analyst/writer to know what information is present and what is absent at the level of individual concepts, procedures, etc. The map level comes closest in similarity and size to the STOP 2-page module. The map, however, is assembled from blocks, while the STOP module is written in prose paragraphs.

Systematic criteria for labeling modules

Another structured writing innovation was the recognition that a criteria and method of specifying the headings and subheadings was needed for a true technology of writing. It goes without saying that I did not invent labeling, and, indeed, the STOP authors were to some degree interested in labels. But, structured writing was the first to specify a systematic criteria for headings and subheadings (called, in the methodology, "block labels" and "map titles"). I specified the criteria for labels for the seven information types, 10 map types, and 40 blocks. I also specified the criteria important for learning use, reference use and for mid-project information management. (Horn, et. al., 1969; see also Horn, 1989) Incorporated in this approach was a three-fold

approach to creating labels: (1) those labels which described the specific content of the subject matter, (2) those labels that described the functions which the block or map performed that were similar across subject matters (e.g. definition, example), and (3) those labels that were combinations of these two types. Each of these types were carefully studied and guidelines for effective use have been prepared. The STOP method includes one page of guidelines that presents five rules for writing headings, while structured writing has many more rules and guidelines (e.g. at least one for each of the 40 block types and seven map types.)

With systematic labeling comes great efficiencies in managing and rearranging the information for different users. Also based on the validity and appropriateness of the content analysis, the method has the ability to specify rules and guidelines at the appropriate level of detail that make them extremely sharp and useful to the writer. This contrasts with the usual experience of writing guidelines which are typically either too detailed or too general to be really useful. The information block and information map types give a powerful focus when writing guidelines. This common language permits intensive and efficient work in teams.

In summary, the importance of the labeling technology is that it:
• enables readers to scan content and quickly understand the structure of the documentation and the subject matter;
• enables readers/learners to find what they are looking for in a consistent, relevant, and complete manner;
• enables analysts/writers to manage the intermediate stages of information gathering and analysis in a more efficient way;
• enables learners to anticipate learning problems by showing the structure to them.

The research-based structured writing approach arose out of my interest in learning research, while the STOP approach critically grew out of practical experience. The structured writing approach has inspired considerable academic research on the methodology. These results can be found summarized in Horn (1992). I am unaware as to whether the STOP approach has attracted enough interest to generate research activity.

The page size question

What is the relationship of the content to the physical limitations of page size? Should the physical page limit the size of the chunks of information? The STOP authors firmly fixed their approach on limiting content to a two page spread and not running over. Initially in structured writing we thought we could have a similar approach, (i.e. one page containing one map.)

But we found with considerable experimentation that there was a wide variety of sizes of maps. They came in sizes from one block to nine, and the blocks (some of which could be tables) also varied in physical size. Thus, our limit, a single page, was impractical. In summary, the STOP approach uses the physical page to limit content chunk size; structured writing does not.

Systematic specification of formats

From its inception, structured writing paid attention to the formatting of content. This was important because readers needed help in coping with the immense amount of information they had to process every day. Much of this information processing in everyday situations of business, science, and technology involved the scanning of documents to find exactly the parts that were important while skipping the rest. Innovations were needed to provide the type of formats that would aid such scanning. Since then, a large variety of formats have been developed to suit different needs of different document types, the most common of which places block labels in the left margins and map titles at the top of pages. STOP's format recommendations focus on the two page format with graphics on the right hand page. These standard formats help the writer get the document ready for print media as well as display on computer screens.

Systematic specification of graphics

Both STOP and structured writing encourage appropriately used graphics placed closely to the text that refers to them. My method of structured writing involved the specification, as a normal part of analysis and writing, of exactly where (i.e. in precisely which information blocks) graphic formats, diagrams and illustrations should be preferred over text. (Horn, et. al. 1969; see also Horn, 1989 and Horn, 1998 for examples of the use of graphics fully integrated with text.) The STOP approach simply encourages the use of graphics and a routine location for them.

Both STOP and structured writing require that the graphic or illustration always be located within the text where the reader needs it, rather than at some other location, as is done in most documents (where the illustration may be located on facing page, next page, or some other place in the document, but not where it is referred to in the text). Structured writing guidelines further specify that information put in the caption of the illustration should often actually be incorporated into the illustration itself so that the reader's eye does not have to search to identify verbal meaning associated with the visual element.

This integration of graphics and words in structured writing enabled readers to more swiftly scan and use documents, because they did not have to search all over the document for illustrations and diagrams and their explanations. It

also ensured that content that should be explained with visuals was developed that way. I have recently become convinced that visual language (Horn, 1998) approaches will become more important than these early predecessors, and that visual language combined with information design (Horn, 1999) will become the major technical approach in the documentation field. I continue to believe that because of the deep analysis of subject matter encapsulated in my structured writing method, it will continue to be of fundamental importance in the analysis of large, complex subject matters.

Summary

I think it is fair to say that both structured writing and STOP were ahead of their time. The constraints of writing for the World Wide Web have forced many more writers to address the need for modularity in their writing in which both STOP and structured writing were pioneers. As already noted, the impact of structured writing has perhaps been greater if we measure in terms of doctoral dissertations. (Horn, 1992) Also, the institutionalization of structured writing in the Information Mapping ® method has been greater than that of STOP in that more than 20,000 persons are taught the Information Mapping method around the world in over 30 countries each year.

Notes

1. I note that Sweeney's book *The Knowledge Explosion* was published in 1966.

2. The earliest publication of the structured writing approach is Horn, et. al., 1969. Most of the literature on structured writing refers to it by a trademarked name "Information Mapping" which is a registered trademark of Information Mapping, Inc., 411 Waverly Road, Waltham, MA 02452-8470. Tel. 781/906-6400, or 1-800-INFOMAP, Fax 781/906-7400, http://www.infomap.com. However the generic term for the approach, which I suggested in the early 1980's, is "structured writing". Often authors of "structured writing" documents use different and more loose standards for analysis, organization and display of information than those who practice Information Mapping's method. The characteristics described in this article refer to those which I first synthesized into Information Mapping's method.

3. The information types were completed in 1965; first published as a schema in Horn (1966); incorporated into a research proposal in 1967 and first published in Horn, et. at. 1969.

4. The formatting innovations are that aspect from which it takes its name. Information has a topography like geographical terrain. Information has peaks and valleys, cities and countryside, and roads and superhighways that

connect them. Like geographical maps, formats should relate to this topology on a point-to-point basis, in so far as possible. Information maps should guide you through the information just like a geographical map does. The ability to show relationships and guide the user quickly to relevant places are features of the formats and the key to the metaphor of Information Mapping's name.

5. Some parts of this paper are quotes and rewrites of my paper Horn (1993).

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The Author

Robert E. Horn is currently a visiting scholar in the Program on People, Computers, and Design at Stanford University's Center for the Study of Language and Information. He is the author of the new book *Visual Language: Global Communication for the 21st Century*. (http://www.macrovu.com) Horn is also the founder, former CEO, and current Chairman of Information Mapping, Inc. (Email: bobhorn@well.com)